MC2000

NTP Time Reference System

User Manual

Version 1.4

worldtime SOLUTIONS

SAFETY PRECAUTIONS

To reduce the risk of fire, or electric shock, ***DO NOT*** allow the MC2000 to be exposed to rain or moisture.

To avoid the risk of electric shock, ***DO NOT*** open the enclosure.

This unit is designed to be installed into an equipment rack or on a suitable flat surface. ***DO NOT*** install this product on an uneven surface.

To prevent damage to the unit, clean ***ONLY*** with a dry cloth.

Use this product ***ONLY*** with the supplied power cord. If the power cord becomes damaged, consult a qualified electrician for advice.

The plug on the supplied power cord is intended to serve as a disconnect device. The socket-outlet should be installed near the equipment and should be easily accessible.

CERTIFICATION

CE

In accordance with European Directives *2006/95/EC (The Low Voltage Directive)* and *2004/108/EC (The Electromagnetic Compatibility Directive)*, the MC2000 is in conformity with the applicable requirements of *BS EN 60950-1:2006 (Information Technology Equipment - Safety)*, *BS EN 55022:2006 (Information Technology Equipment - Radio disturbance characteristics - class B)* and *BS EN 55024:2003 (Information Technology Equipment - Immunity characteristics)*.

A copy of the EC Declaration of Conformity is included at the rear of this user manual. Copies of the original document may be downloaded from our web site at:

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For further information, please visit our web site at:

`www.worldtimesolutions.com/rohs.html`

DISPOSAL

Please dispose of this unit properly. To minimize pollution and help protect the environment, this unit should be recycled.

For further information and/or to view a copy of the *World Time Solutions Limited Waste Electrical and Electronic Equipment Policy*, please visit our web site at:

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LIMITED WARRANTY

The MC2000 NTP Time Reference system is guaranteed against failure due to faulty parts or workmanship for a period of five (5) years from date of purchase.

In the event of product failure due to faulty parts or workmanship within the warranty period, World Time Solutions Limited, at its own discretion, will either (a) repair the product, (b) supply a replacement product, (c) supply a functionally equivalent replacement product, or (d) refund the purchase price of the product.

The limited warranty will not apply if (a) the product has not been installed or operated as per our instructions, (b) the product has been modified in anyway.

In the event of failure, the MC2000 should be returned to the manufacturer for inspection and repair. Please visit our support pages for further details:

`www.worldtimesolutions.com/support.html`

TECHNICAL SUPPORT

To obtain help with the installation or operation of the MC2000, please visit our web site at:

`www.worldtimesolutions.com/support.html`

Contents

1 - Introduction 1
1.1 - Quick start guide 1
1.2 - Package contents 1
1.3 - Front & Rear drawings 2
1.4 - LCD time and status displays 3

2 - Installing the MC2000 4
2.1 - Physical installation 4
2.2 - Remote synchronisation input connections 4
2.3 - Mains power connection 5
2.4 - Local area network connections 5

3 - Network setup 6
3.1 - How to enter the network setup menus 6
3.2 - Changing the DHCP setting 6
3.3 - Programming static IP settings. 7

4 - Setting the time zone 8
4.1 - Setting the local time zone 8

5 - Remote access 9
5.1 - Remote access via the network interface 9
5.2 - Remote access via the USB interface 12

6 - Advanced setup 14
6.1 - Accessing advanced setup 14

7 - Software updates 16
7.1 - Applying a timing software update 16
7.2 - Updating the network software 18

A - Troubleshooting 20

B - Menu structure 22

C - Time zones 24

D - Specifications 26

E - Certificate of Conformity 27

1 - Introduction

The World Time Solutions MC2000 NTP Time Reference System is a dual LAN NTP time server. The system is designed for use in applications where two discrete networks individually require a secure local source of accurate time.

The MC2000 obtains time information from a connected antenna and uses this data to service NTP time requests from multiple devices on two distinct TCP/IP networks. The MC2000 is based around proprietary software for enhanced security. It also incorporates two embedded Linux systems each providing highly stable network communications.

What is NTP?

Network Time Protocol (NTP) enables the synchronisation of computer clocks across data networks. It was originally proposed in the early 1980s and has been continually updated and used ever since.

Further information may be found at the home of the NTP project:

http://www.ntp.org

1.1 - Quick start guide

The following list of procedures can be used for rapid installation of the MC2000:

- Install the MC2000 into a 19” equipment rack or on a suitable surface *(see section 2.1).*
- Install and connect a suitable antenna system to one of the remote synchronisation inputs *(see section 2.2)*.
- Connect the MC2000 to a suitable 100-240 VAC mains power supply *(see section 2.3)*.
- Enter the required network address settings or enable DHCP operation for each LAN port *(see section 3)*.
- Select the local time zone *(see section 4.1 & appendix C)*.
- Connect each LAN port to a TCP/IP Ethernet network via a network switch or hub *(see section 2.4)*.

For optimal setup, the following additional procedure should be performed:

- Set Telnet & HTTP remote access settings *(see section 5.1)*.

1.2 - Package contents

The MC2000 is supplied with the following component parts:

- MC2000 NTP Time Reference System
- IEC style mains lead
- CAT5 patch cable (x2)
- USB cable
- 19” rack fixing bolts

- Rubber feet
- A4 user manual
- *MC2000 Utilities* and *Microsoft® .NET framework* CD-ROMs

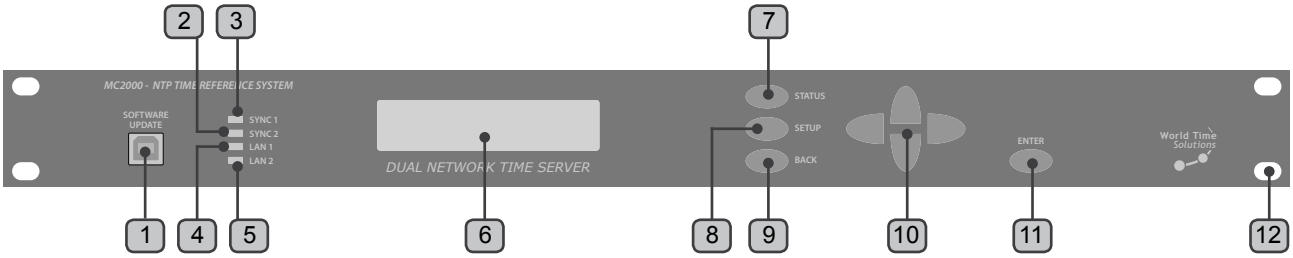
The package may also contain the following:

- Either one or two compatible antenna systems

1.3 - Front & Rear drawings

The drawings below show the front and rear view of the MC2000.

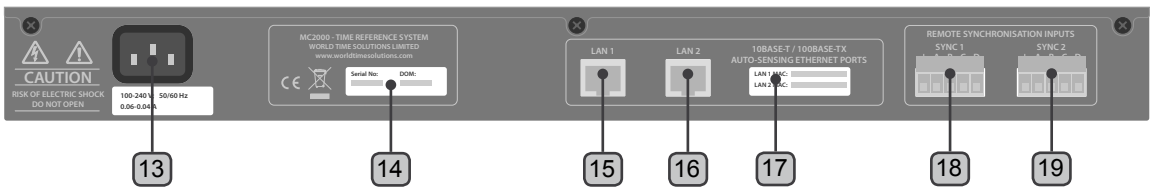
1.3.1 - MC2000 front view



No.	Function	No.	Function
1	USB port	7	Status switch
2	Sync 2 status LED	8	Setup switch
3	Sync 1 status LED	9	Back/Exit switch
4	LAN 1 LINK status LED	10	Multifunction switches
5	LAN 2 LINK status LED	11	Enter switch
6	Liquid crystal display (LCD)	12	Rack mounting ears

Table 1.1 - Front panel functions

1.3.2 - MC2000 rear view



No.	Function	No.	Function
13	IEC Mains inlet	17	MAC addresses
14	Serial number	18	Remote Synchronisation Port Sync 1 input
15	LAN 1 Ethernet connection	19	Remote Synchronisation Port Sync 2 input
16	LAN 2 Ethernet connection		

Table 1.2 - Rear panel functions

1.4 - LCD time and status displays

In normal operation, the liquid crystal display (LCD) shows the local time, the local date and the offset from UTC. The MC2000 also has four status display screens accessible via the *'STATUS'* switch. The status display screens show basic information from the connected antenna systems and the status of the network interfaces.

1.4.1 - Standard time and date display

No.	Function	No.	Function
20	Local time	22	Offset from UTC (replaced by 'SYNC ERROR' if the time has not been set)
21	Local date	23	Daylight saving time indicator

Table 1.3 - Standard time and date display functions

1.4.2 - Sync 1 & Sync 2 status displays

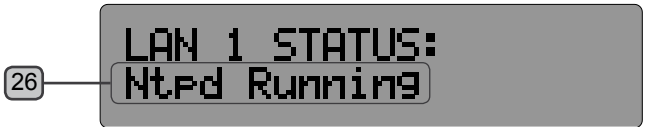
The Sync 1 status display is accessible by pressing the 'STATUS' switch on the front panel. With a further press of the status switch, a similar Sync 2 status display is shown.

No.	Function	No.	Function
24	Antenna system type	25	Antenna status

Table 1.4 - Sync 1 status display functions

1.4.3 - LAN 1 & LAN 2 status displays

The LAN 1 status display is located after the two sync status display screens and can be accessed by a further depression of the 'STATUS' switch. Press again to view the LAN 2 status, then again to exit.



No.	Function
26	LAN 1 status

Table 1.5 - LAN 1 status display functions

2 - Installing the MC2000

The MC2000 is supplied in a robust metal case suitable for mounting into an industry standard 19” rack. The system requires a mains power source, connections to two local area networks and connection to a compatible World Time Solutions Time Receiver System.

System setup may be performed using the front panel switches. Alternatively, the system setup may be adjusted using the supplied MC2000 Interface software application, for which a temporary USB connection is required *(see section 5.2)*.

2.1 - Physical installation

The MC2000 has been designed for installation into an industry standard 19” rack. The unit is 1U high (44mm - 1.75”) and is supplied with four M6 rack screws.

The unit is also supplied with rubber feet for non-rack mounting installations. These should be fitted to the underside, enabling the unit to be placed on a suitable surface.

2.2 - Remote synchronisation input connections

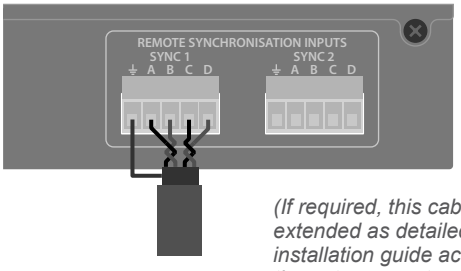
The MC2000 has two remote synchronisation inputs for connection to compatible World Time Solutions Time Receiver systems. The MC2000 is designed to operate with either one or two antenna systems connected. In installations using two antenna systems, the MC2000 uses the second antenna as a live backup system.

2.2.1 - Installing the antenna system

The antenna system/s should be installed as specified in the accompanying installation guide.

2.2.2 - Connecting the antenna system to the MC2000

The antenna system/s should be connected to one of the Remote Synchronisation Inputs using the supplied cable. Connections should be made as shown in the installation guide accompanying the antenna system. Please also refer to the antenna installation guide for details of how the cable may be extended.



(If required, this cable may be extended as detailed in the installation guide accompanying the antenna system.)

2.2.3 - Antenna system setup and status

When mains power is connected, the MC2000 monitors the status of any connected antennae and automatically selects the most stable and accurate as a synchronisation reference source.

All compatible World Time Solutions Time Receiver systems incorporate setup information into data messages sent to the MC2000. This setup information is used by the MC2000 to perform any required setup changes automatically. Therefore, new or different antenna systems can be connected to the MC2000 in the future without any programming changes by the user.

The status of connected antenna systems may be confirmed remotely via the web page status screen or MC2000 Interface software application *(see section 5)* or visually via the front panel LEDs. Each Remote Synchronisation Input has a dedicated status indication LED. The table below shows the LED states and indicated conditions:

LED State	Antenna Synchronisation Status
Green	Antenna system is synchronised and is the selected time reference for MC2000
Yellow	Antenna system is synchronised but is not the selected time reference for MC2000
Red	Antenna system is unsynchronised
Off	No antenna system detected

Table 2.1 - Remote Synchronisation Input status LED indications

More detailed information regarding antenna synchronisation status may be obtained via the sync status screens *(see section 1.4.2)*.

2.3 - Mains power connection

The MC2000 should be connected to a 110-240 VAC mains power source using the supplied IEC mains cable.

For system protection and safety, the MC2000 is fitted with an internal fuse. This fuse should only be replaced by qualified personnel.

2.4 - Local area network connections

PLEASE NOTE: In order to prevent possible network setup conflicts, it is recommended that the MC2000 is not connected to the network before the Network Setup Procedure in section 3 has been completed.

The MC2000 has two 10BASE-T/100BASE-TX auto-sensing Ethernet ports. Each port should be connected to an Ethernet switch/hub on a TCP/IP network using one of the supplied CAT5 patch cables (or similar).

3 - Network setup

The MC2000 has two fully independent Ethernet ports *(LAN 1 and LAN 2)* to allow connection to two separate TCP/IP networks.

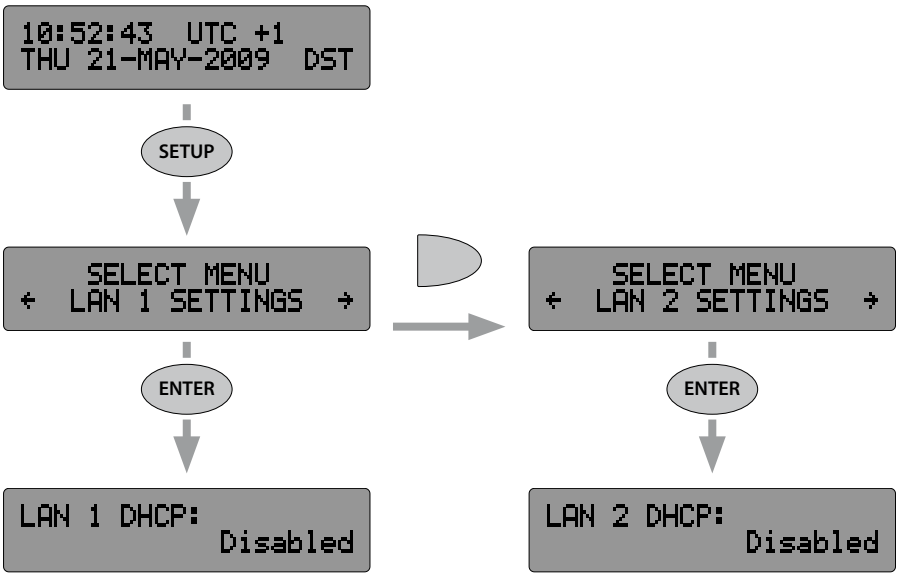
Each network interface may be programmed to operate with DHCP enabled or disabled. When DHCP operation is enabled, the MC2000 attempts to obtain network address settings automatically from a DHCP server on the network. With DHCP disabled, network address settings are manually entered into the unit.

The network settings for each port may be adjusted following the procedures detailed below or alternatively via the USB interface and MC2000 Interface software *(see section 5.2 for further details).*

> What is DHCP?
>
> Dynamic Host Configuration Protocol (DHCP) enables the automatic assignment of IP address settings on a TCP/IP network.
>
> Upon connection to a TCP/IP network, a client device configured for DHCP operation communicates with the DHCP server and obtains an IP address lease.
>
> The DHCP protocol is defined in RFC 2131, available for download from:
>
> http://www.rfc-editor.org

3.1 - How to enter the network setup menus

The LAN 1 and LAN 2 network setup menus can be accessed using the front panel switches as shown in the graphic below:

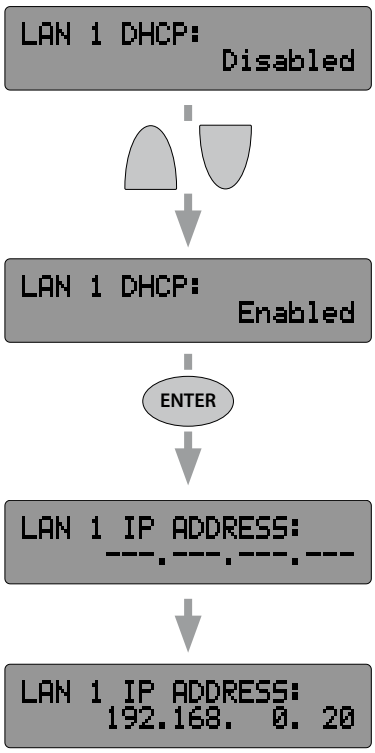


3.2 - Changing the DHCP setting

Once the LAN 1 DHCP option screen is displayed, pressing either the *'UP'* or *'DOWN'* switches will toggle the LAN 1 DHCP mode. When the correct mode has been selected, pressing the *'ENTER'* switch will forward on through the remaining LAN 1 setup menu options. LAN 2 may be programmed in a similar manner *(in the LAN 2 setup menu)*.

If DHCP is enabled, the remaining LAN 1 setup screens will show the IP settings obtained from the DHCP server. If LAN 1 has not yet obtained a DHCP lease, the IP address, subnet and gateway screens will show '---.---.---.---' in place of a valid network address.

From this point, the LAN 1 setup menu may be exited by a further three presses of the *'ENTER'* switch. LAN 2 operates in a similar way.

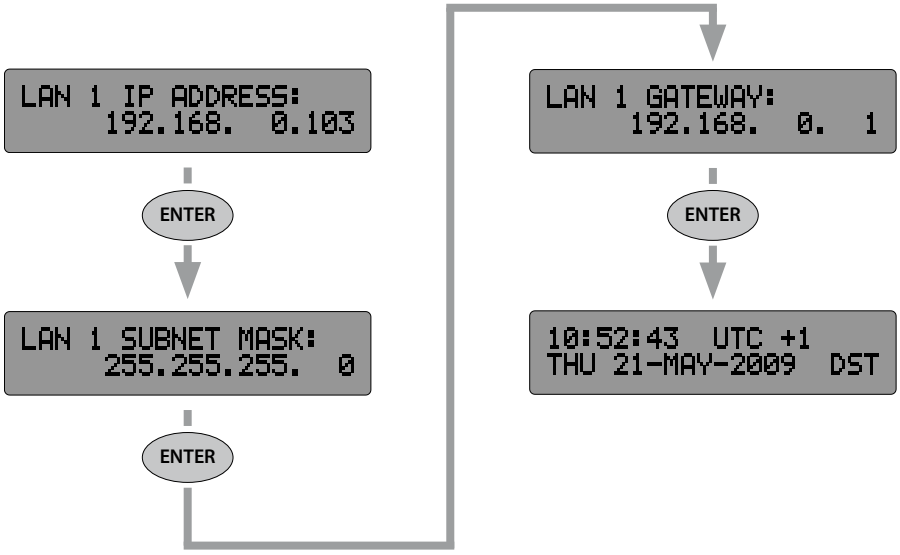


The status of both network connections can also be confirmed by displaying the LAN 1 and LAN 2 status screens *(see section 1.4.3)*.

3.3 - Programming static IP settings.

If DHCP operation for a particular port is disabled, the MC2000 uses the IP address, subnet and gateway addresses as programmed in the relevant setup menu for that port.

The IP settings for each port can be adjusted one byte at a time with the selected byte flashing. The *'UP'* and *'DOWN'* multi-function switches increment and decrement the byte value; the *'LEFT'* and *'RIGHT'* multi-function switches are used to change the selected byte. Pressing the *'ENTER'* switch will move on to the next screen or finally exit the menu.



4 - Setting the time zone

NTP (Network Time Protocol) always operates using UTC as a time reference *(see side panel for further details)*. It does not include any information regarding local time or daylight saving time changes. The MC2000 operates in a similar manner, using UTC for the main internal time count.

In order to enable simple user monitoring of time accuracy, the MC2000 also has a local time count. As part of the initial setup procedure, the user should select the local time zone from a preprogrammed list. The MC2000 then calculates the actual local time from the internal UTC time count and displays this local time on the front panel LCD. The preprogrammed time zones incorporate seasonal time change information which will occur automatically.

Appendix C lists the preprogrammed time zones along with offsets from UTC. The time zone may be adjusted following the procedure detailed below or alternatively via the USB interface and supplied MC2000 Interface software *(see section 5.2 for further details)*.

What is UTC?

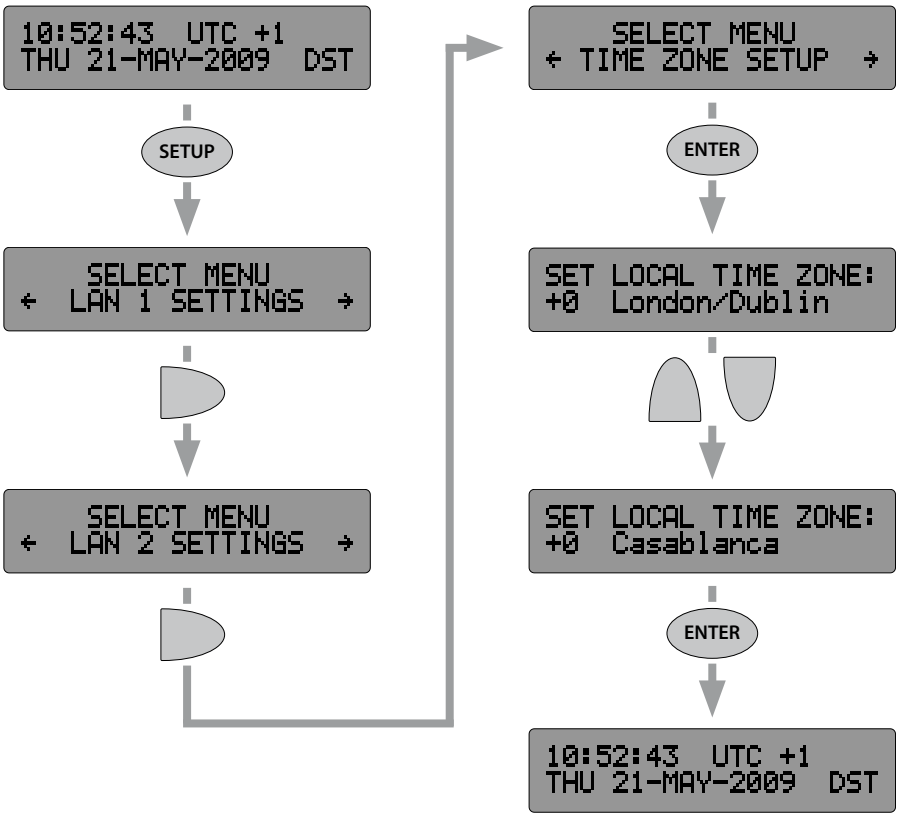
In the early 1970s, with the increase in timing accuracy made available by modern atomic clocks, Coordinated Universal Time (UTC) replaced Greenwich Mean Time (GMT) as the world's time scale.

Historically, GMT calculated the length of a day based on solar time patterns. UTC uses highly accurate atomic clocks as a calculation base.

See also... 'What is a leap second?' (section 6).

4.1 - Setting the local time zone

The local time zone should be adjusted as shown in the diagram below. Once the local time zone screen is displayed, the selected time zone can be adjusted using either the *'UP'* or *'DOWN'* multi-function switches. Please refer to appendix C for details of available preprogrammed time zones.



5 - Remote access

Status and setup information can be accessed remotely, either via one of the network connections *(using either the built in HTTP web server or Telnet)* or through the USB port.

During normal operation, remote access via either network interface may be used to obtain status information. The USB port, together with the supplied MC2000 Interface software application may be used to obtain both status information and to adjust any settings that may be programmed using the front panel switches.

The table below details what may be achieved using the different access modes:

	LAN 1 / LAN 2				USB	
	Web page		Telnet			
	read	write	read	write*	read	write
Network settings	yes	-	yes	-	yes	yes
Local time zone	-	-	-	-	yes	yes
Remote access	yes	-	-	-	yes	yes
Advanced settings	-	-	-	-	yes	yes
Network status	-	-	yes	-	yes	-
Antenna status	yes	-	-	-	yes	-

Table 5.1 - Remote access modes

** PLEASE NOTE: Whilst it is possible to alter Linux system settings via the Telnet interface, any changes will be lost when power to the unit is disrupted.*

5.1 - Remote access via the network interface

System status and setup information may be accessed via either of the network interfaces, using the integrated web server or Telnet.

5.1.1 - HTTP web page access

The MC2000 incorporates an integrated HTTP web server, allowing system setup and status information to be accessed from a standard web browser on your local area network. The web page shows information relating to attached antenna systems, current network settings *(for the relevant local area network port only)*, remote access availability and basic hardware/software information.

To access the web page, enter the IP address of the relevant LAN port into the address bar of a web browser *(as shown in the example below where 192.168.0.103 is the IP address of the port)*:

```
http://192.168.0.103
```

An example web page is shown on the following page. By default, HTTP access is enabled. Please refer to section 5.1.3 for details of how to disable HTTP access.

For troubleshooting advice, please refer to appendix A.

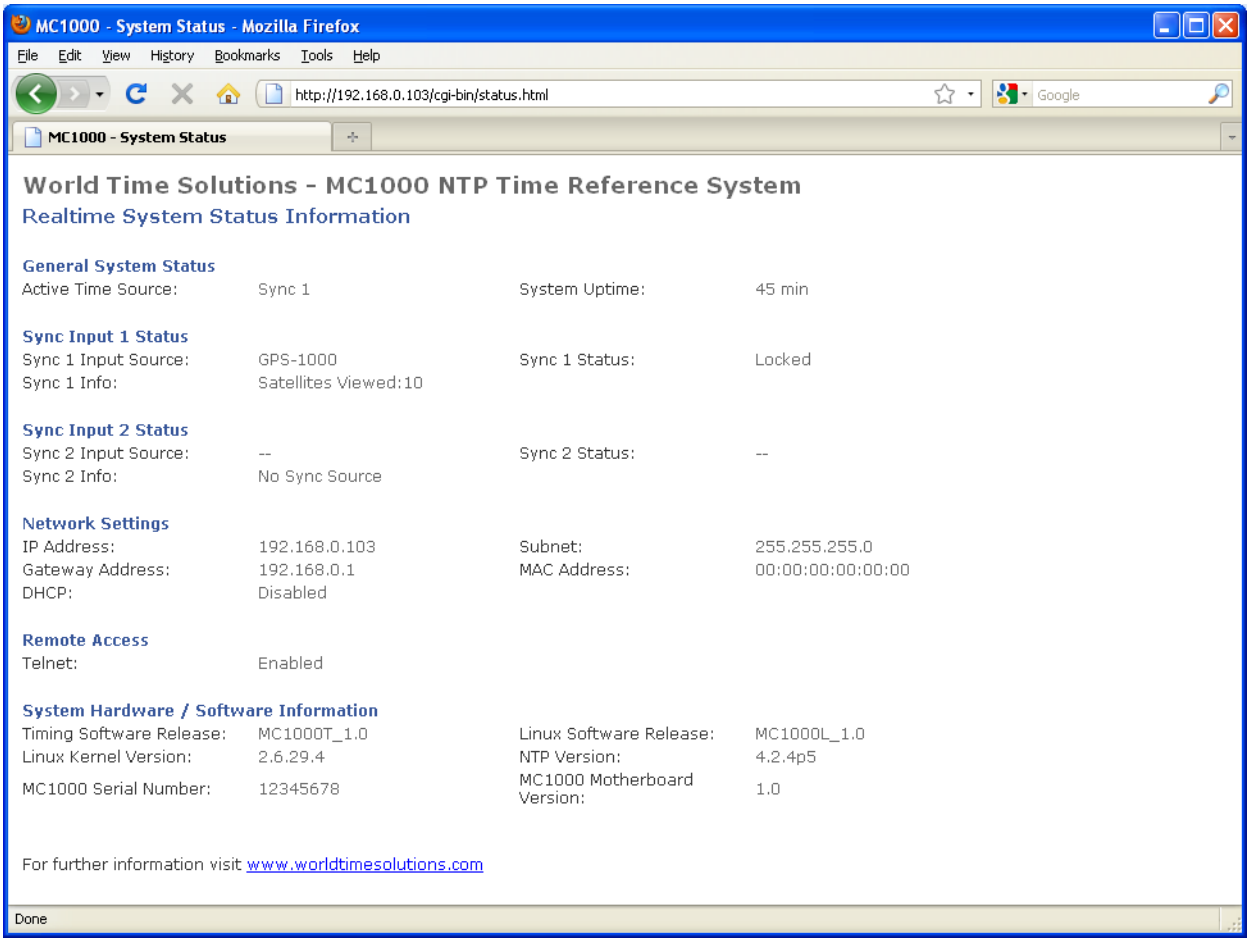


Figure 5.1 - Example web page

5.1.2 - Telnet access

Telnet allows access to the internal file systems of the Linux operating system *(for that port only - LAN 1 or LAN 2)* via a command line interface *(see side panel for further details)*.

Upon accessing the unit via Telnet, a section of welcome text will be displayed explaining that any changes made via the Telnet interface will be lost when system power is removed *(as shown in the example below)*.

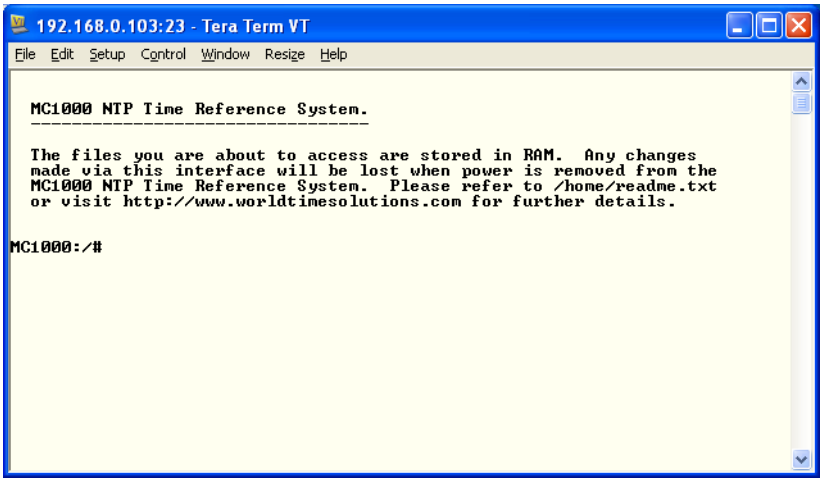

192.168.0.103:23 - Tera Term VT
File Edit Setup Control Window Resize Help
MC1000 NTP Time Reference System.
The files you are about to access are stored in RAM. Any changes made via this interface will be lost when power is removed from the MC1000 NTP Time Reference System. Please refer to /home/readme.txt or visit http://www.worldtimesolutions.com for further details.
MC1000:/#

Figure 5.2 - Telnet interface example

What is Telnet?

Telnet is a communications protocol, typically used to enable remote access to a networked computer via a command line interface.

Data transferred via the Telnet protocol is unencrypted and, as such, is typically only used in a low risk network environment.

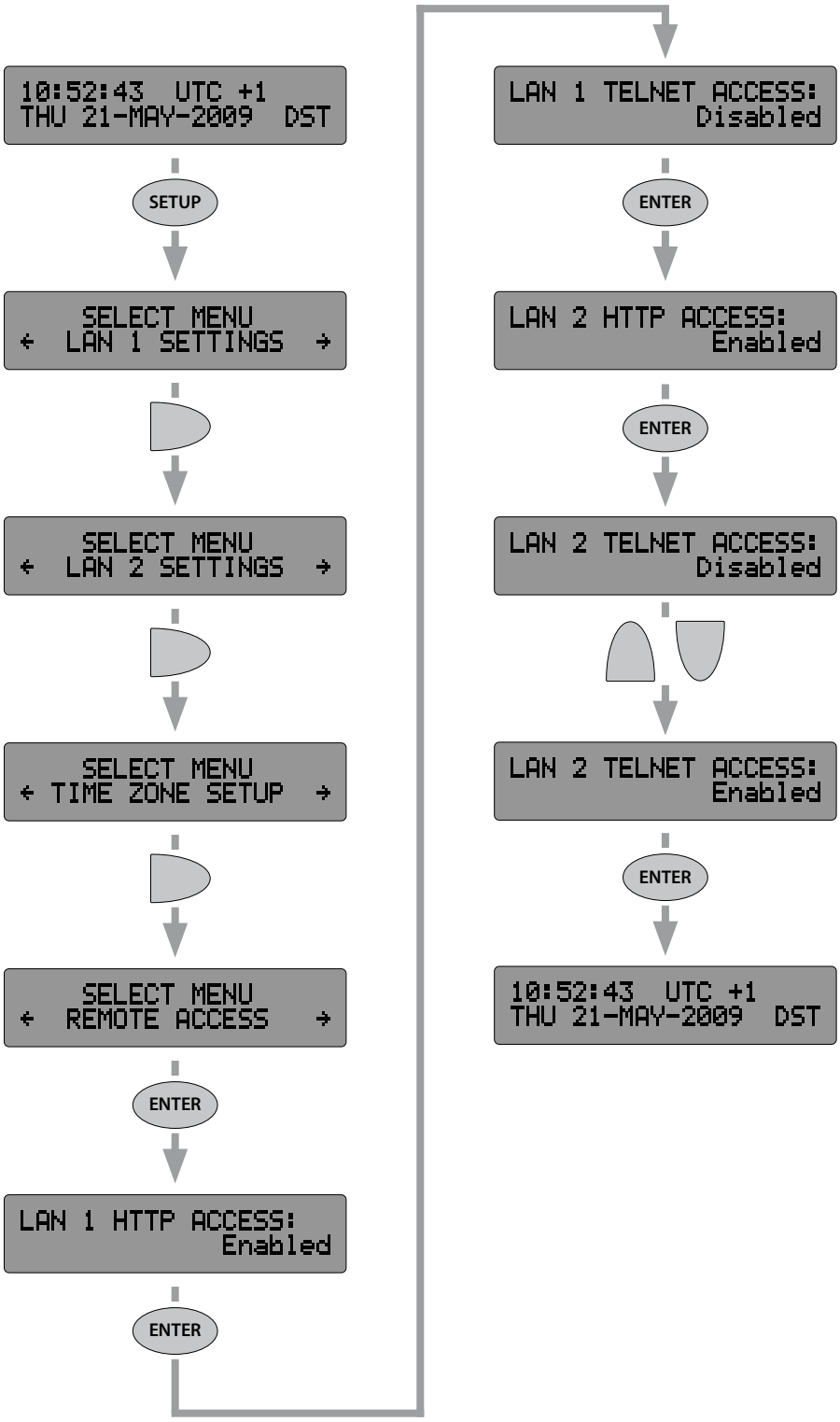
The Telnet protocol is defined in RFC 854, available for download from:

http://www.rfc-editor.org

Information transmitted using the Telnet protocol is unencrypted, therefore care should be exercised when using this function in certain applications. Please note that Telnet access is disabled by default.

5.1.3 - Enabling / disabling HTTP / Telnet access

The MC2000 is supplied with HTTP access enabled and Telnet access disabled for both network ports. The graphic below shows how the current access settings can be confirmed and, by way of example, Telnet access enabled on LAN 2 only:



5.2 - Remote access via the USB interface

The supplied MC2000 Interface software application enables the MC2000 to be fully programmed from a remote PC via the USB interface. All settings normally accessed using the front panel switches can be confirmed and adjusted using this software application. The software is also used for downloading upgraded software versions into the MC2000 *(see section 7)*.

The software is supplied with the MC2000 on a CD-ROM. Copies are also available for download from the World Time Solutions web site:

`http://www.worldtimesolutions.com`

5.2.1 - Installing the MC2000 Interface software application

PLEASE NOTE: The USB drivers should be installed prior to connecting the MC2000 to the PC.

The software should be installed on a *Microsoft® Windows® XP* SP2 *(or later), Windows Vista™ or Windows® 7* PC, observing the following procedure:

- Insert the supplied 'MC2000 Utilities' CD-ROM into a DVD/CD reader on the PC.
- The 'MC2000 Utilities' program should automatically run. If the program fails to start, run 'MC2000_Utilities.exe'. (Note: Users of Windows XP may be asked to install the *Microsoft® .NET framework*. This is supplied on a separate CD-ROM and should be installed prior to proceeding).
- In the MC2000 Utilities window, click 'Install USB Drivers'.
- Once the USB drivers have been installed, connect the MC2000 to the PC, using the supplied USB cable.
- Again in the MC2000 Utilities window, click 'Install MC2000 Interface Software'. The MC2000 Interface will start automatically.

For troubleshooting advice, please refer to appendix A.

5.2.2 - Controlling the MC2000 via the Interface software

The MC2000 Interface software is arranged using a tabbed menu system, with a separate tab provided for each of the main setup menus. Additional tabs are also provided for status information and software updates.

Initially, the status tab is displayed *(see figure 5.3)*. Click on any of the other tab titles near the top of the window to access other tabs *(as shown in figures 5.4 - 5.8)*. The software update tab is shown in Figure 7.1 *(see section 7)*.

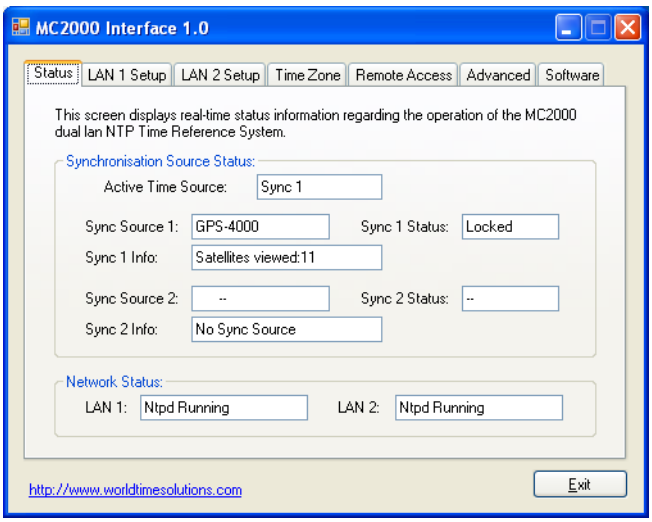


Figure 5.3 - MC2000 Interface application - Status tab

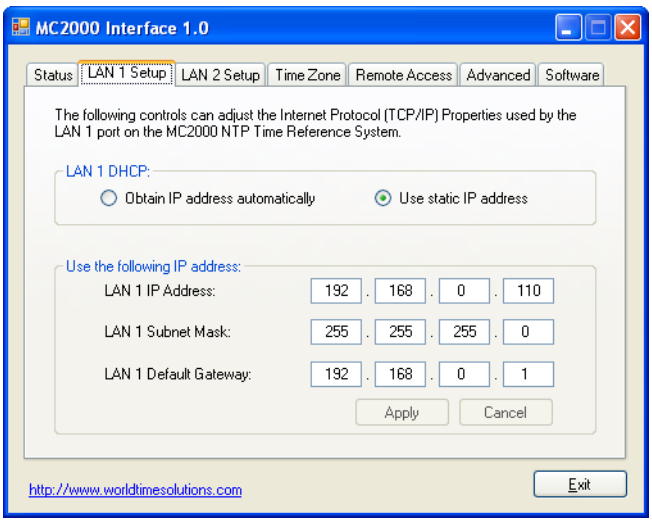

MC2000 Interface 1.0
Status
LAN 1 Setup
LAN 2 Setup
Time Zone
Remote Access
Advanced
Software
The following controls can adjust the Internet Protocol (TCP/IP) Properties used by the LAN 1 port on the MC2000 NTP Time Reference System.
LAN 1 DHCP:
Obtain IP address automatically
Use static IP address
Use the following IP address:
LAN 1 IP Address:
192 . 168 . 0 . 110
LAN 1 Subnet Mask:
255 . 255 . 255 . 0
LAN 1 Default Gateway:
192 . 168 . 0 . 1
Apply
Cancel
http://www.worldtimesolutions.com
Exit

Figure 5.4 - MC2000 Interface application - LAN 1 Setup tab

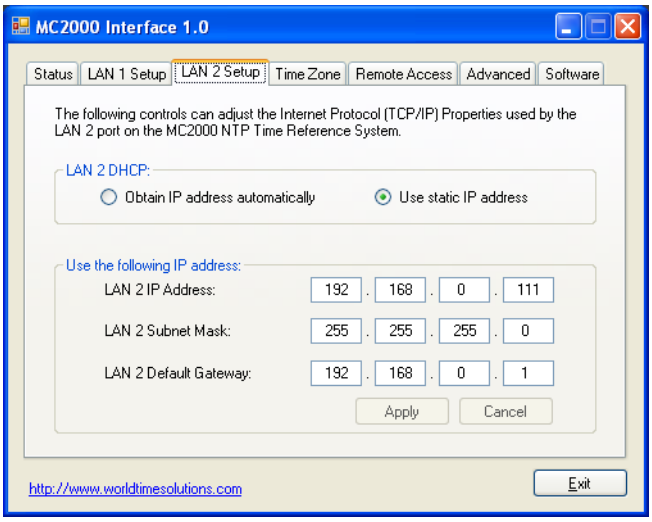

MC2000 Interface 1.0
Status
LAN 1 Setup
LAN 2 Setup
Time Zone
Remote Access
Advanced
Software
The following controls can adjust the Internet Protocol (TCP/IP) Properties used by the LAN 2 port on the MC2000 NTP Time Reference System.
LAN 2 DHCP:
Obtain IP address automatically
Use static IP address
Use the following IP address:
LAN 2 IP Address:
192 . 168 . 0 . 111
LAN 2 Subnet Mask:
255 . 255 . 255 . 0
LAN 2 Default Gateway:
192 . 168 . 0 . 1
Apply
Cancel
http://www.worldtimesolutions.com
Exit

Figure 5.5 - MC2000 Interface application - LAN 2 Setup tab

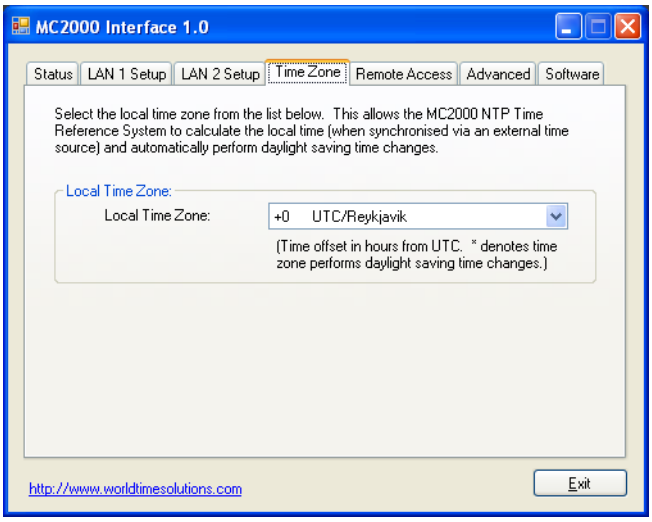

MC2000 Interface 1.0
Status
LAN 1 Setup
LAN 2 Setup
Time Zone
Remote Access
Advanced
Software
Select the local time zone from the list below. This allows the MC2000 NTP Time Reference System to calculate the local time (when synchronised via an external time source) and automatically perform daylight saving time changes.
Local Time Zone:
Local Time Zone:
+0 UTC/Reykjavik
(Time offset in hours from UTC. * denotes time zone performs daylight saving time changes.)
http://www.worldtimesolutions.com
Exit

Figure 5.6 - MC2000 Interface application - Time Zone tab

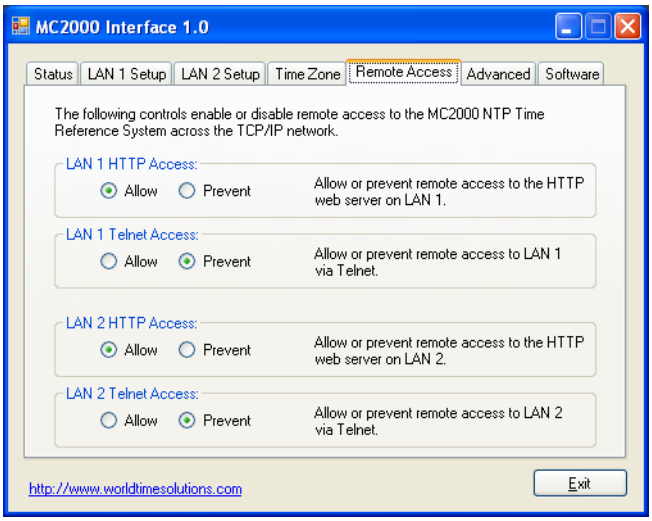

MC2000 Interface 1.0
Status
LAN 1 Setup
LAN 2 Setup
Time Zone
Remote Access
Advanced
Software
The following controls enable or disable remote access to the MC2000 NTP Time Reference System across the TCP/IP network.
LAN 1 HTTP Access:
Allow
Prevent
Allow or prevent remote access to the HTTP web server on LAN 1.
LAN 1 Telnet Access:
Allow
Prevent
Allow or prevent remote access to LAN 1 via Telnet.
LAN 2 HTTP Access:
Allow
Prevent
Allow or prevent remote access to the HTTP web server on LAN 2.
LAN 2 Telnet Access:
Allow
Prevent
Allow or prevent remote access to LAN 2 via Telnet.
http://www.worldtimesolutions.com
Exit

Figure 5.7 - MC2000 Interface application - Remote Access tab

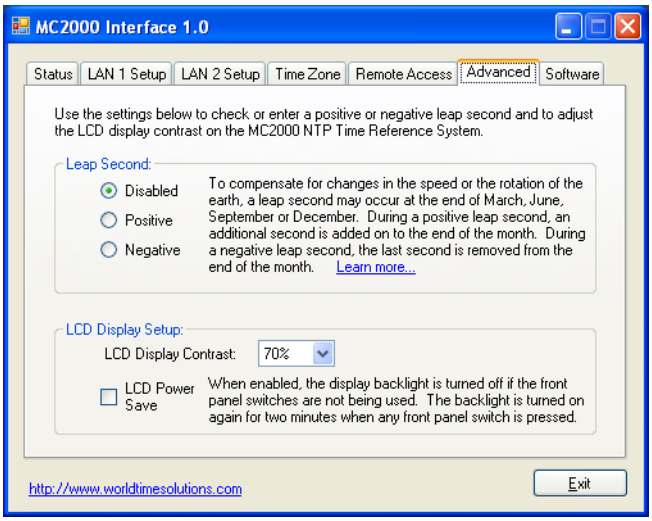

MC2000 Interface 1.0
Status
LAN 1 Setup
LAN 2 Setup
Time Zone
Remote Access
Advanced
Software
Use the settings below to check or enter a positive or negative leap second and to adjust the LCD display contrast on the MC2000 NTP Time Reference System.
Leap Second:
Disabled
Positive
Negative
To compensate for changes in the speed or the rotation of the earth, a leap second may occur at the end of March, June, September or December. During a positive leap second, an additional second is added on to the end of the month. During a negative leap second, the last second is removed from the end of the month.
Learn more...
LCD Display Setup:
LCD Display Contrast:
70%
LCD Power Save
When enabled, the display backlight is turned off if the front panel switches are not being used. The backlight is turned on again for two minutes when any front panel switch is pressed.
http://www.worldtimesolutions.com
Exit

Figure 5.8 - MC2000 Interface application - Advanced tab

6 - Advanced setup

The Advanced Setup menu contains various settings, most of which typical users should not need to access or adjust. Settings may be adjusted following the procedure detailed in section 6.1 below, or alternatively via the USB interface and supplied MC2000 Interface software application *(see section 7 for further details)*.

The table below details the options in the Advanced Setup menu:

Advanced Setup Menu Option	Description Of Function
Set local time	Allows local time to be adjusted. This should only be adjusted if the MC2000 has no active remote synchronisation reference. Note that before adjusting this setting, the time zone must be programmed *(see section 4.1)*.
Set local date	Allows local date to be adjusted. This should only be adjusted if the MC2000 has no active remote synchronisation reference. Note that before adjusting this setting, the time zone must be programmed *(see section 4.1)*.
Leap second	Enables the user to manually set a positive (1 second added) or negative (1 second removed) leap second *(see side bar)*. If programmed, the leap second will occur once only at the end of the following March, June, September or December (which ever occurs first) and then be erased.
Display contrast	Allows adjustment of liquid crystal display contrast to aid viewing at different angles.
LCD power save	When enabled, switches off liquid crystal display backlight if switches have not been active for 2 mins.
Serial number	MC2000 serial number. *(Read only)*
LAN 1 MAC address	LAN1 Media Access Control address. *(Read only)*
LAN 2 MAC address	LAN2 Media Access Control address. *(Read only)*
Timing software	Current timing software version. *(Read only)*
LAN 1 software	Current LAN 1 software version. *(Read only)*
LAN 2 software	Current LAN 2 software version. *(Read only)*
Hardware revision	MC2000 build revision. *(Read only)*
SYNC 1 software	SYNC 1 software version. *(Read only)*
SYNC 1 hardware	SYNC 1 build revision. *(Read only)*
SYNC 2 software	SYNC 2 software version. *(Read only)*
SYNC 2 hardware	SYNC 2 build revision. *(Read only)*

Table 6.1 - Advanced Setup menu options

What is a leap second?

The average rotational speed of the earth is very slowly decreasing and therefore the average length of a solar day is very slowly increasing.

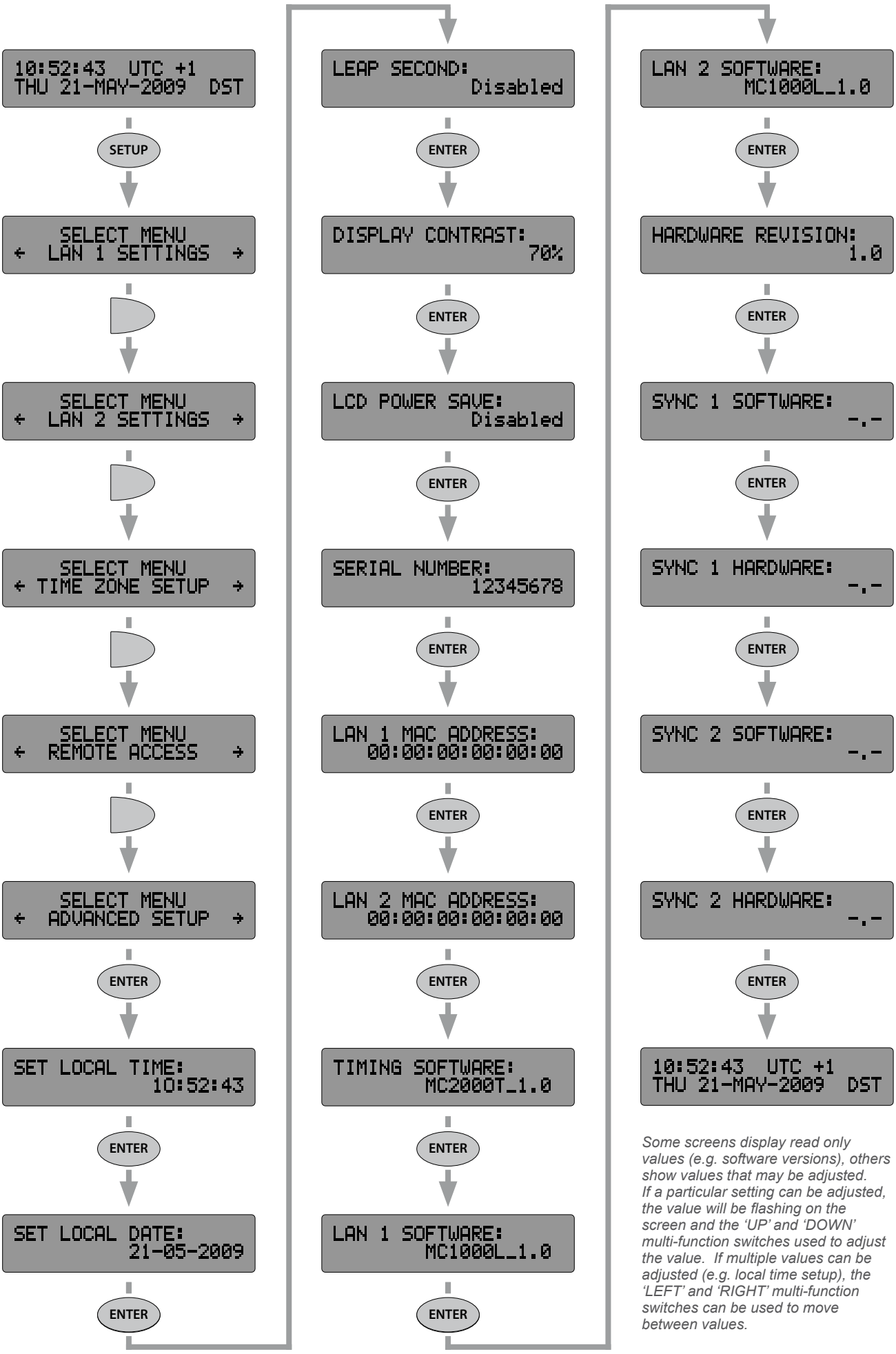
To enable time counts based on solar day observations to be kept in alignment with international time scales, an extra second is occasionally added to UTC at the end of June or December.

Assuming the MC2000 is connected to a leap second capable antenna system, leap seconds will be handled automatically, with the leap second setting (found in the Advanced Setup menu) being adjusted up to one month in advance of the event.

See also... 'What is UTC?' (section 4).

6.1 - Accessing advanced setup

The advanced setup configuration can be confirmed using the procedure shown in the diagram on the following page.



Some screens display read only values (e.g. software versions), others show values that may be adjusted. If a particular setting can be adjusted, the value will be flashing on the screen and the 'UP' and 'DOWN' multi-function switches used to adjust the value. If multiple values can be adjusted (e.g. local time setup), the 'LEFT' and 'RIGHT' multi-function switches can be used to move between values.

7 - Software updates

Occasionally, updated software versions may become available for the MC2000. The updated software may include capability upgrades or enhancements, Linux revisions or updates due to changes in time zone daylight saving rules. Updated software revisions are available at the World Time Solutions web site:

`http://www.worldtimesolutions.com`

The MC2000 has three software versions; the proprietary timing software and two network software versions. The timing software *(software versions MC2000T_x.x)* incorporates the synchronisation and time count, user interface, and time zone calculation code and is installed via the USB interface. The LAN 1 & LAN 2 network software *(software versions MC1000L_x.x)* incorporate the Linux, NTP and network interface code and are installed using both the USB interface and a TFTP server running on your local network.

7.1 - Applying a timing software update

The following details the procedure to update the timing software version in the MC2000. Updated timing software versions should be loaded into the MC2000 via the USB connection using the MC2000 Interface software application.

Before commencing this procedure, the updated software version *(MC2000T_x.x)* should be obtained from the World Time Solutions web site:

`http://www.worldtimesolutions.com`

The new software release should be saved on the PC for installation later in this procedure.

- If these have not already been installed, install the USB drivers *(see section 5.2)*.
- Once the USB drivers have been installed, connect the MC2000 to the PC using the supplied USB cable.
- Install *(if this has not already been installed)* and run the MC2000 Interface software application *(see section 5.2)*.
- In the main window of the MC2000 Interface software application, click on the *'Software'* tab *(see figure 7.1 on the following page)*.
- In the section labelled *'Timing and User Interface Control Software'*, click on the *'Update'* button *(see figure 7.1)*. The *'Timing Software Update'* window will appear *(figure 7.2)*.

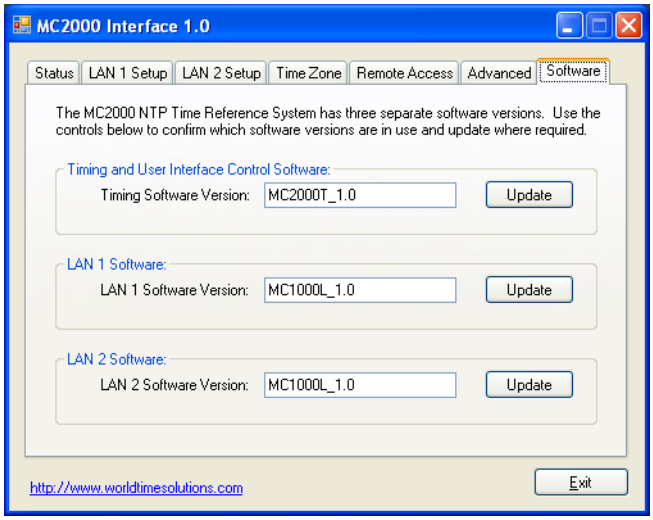


Figure 7.1 - MC2000 Interface application - Software Update tab

- In the section labelled *'Timing Software Version'* the current timing software version is shown. Click the *'Browse'* button. A *'File Open'* window will appear.
- Select the recently downloaded file *(MC2000T_x.x)* and click *'Open'*. The new file version will now be displayed in the *'Replacement Timing Software Version'* text box.
- Click the *'Start Update Procedure'* button. The replacement software will now be uploaded into the MC2000 via the USB connection. The 'Timing Software Update Progress' section details the procedures being performed and overall progress.
- Once the update is complete, click on the 'Exit' button.

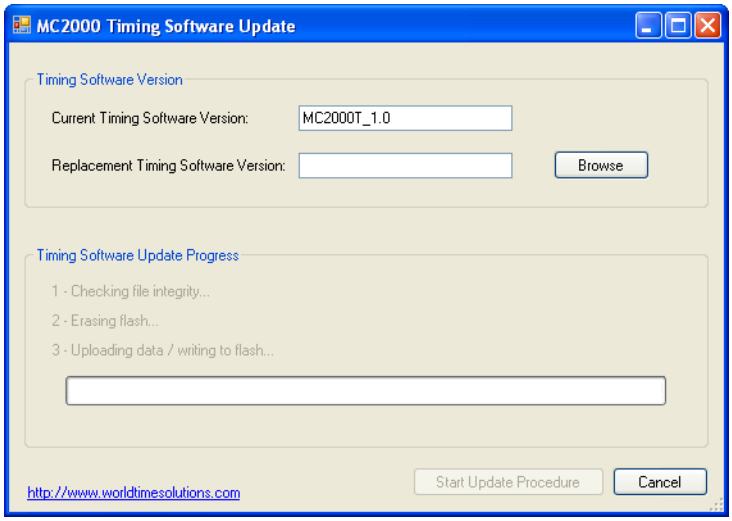


Figure 7.2 - MC2000 Timing Software Update window

For troubleshooting advice, please refer to appendix A.

7.2 - Updating the network software

The LAN 1 or LAN 2 network software versions may be updated following the procedure detailed below. The network software files are loaded into the MC2000 from a TFTP server on the local area network. The update procedure is controlled via the USB connection and MC2000 Interface software application.

When updating the LAN 1 software, the TFTP server should be accessible on the LAN 1 network. When updating the LAN 2 software, the TFTP server should be accessible on the LAN 2 network.

Before commencing this procedure, a functioning TFTP server should be running on the relevant local area network *(see side bar)*. In addition, the updated software package *(MC1000L_x.x) should be o*btained from the World Time Solutions web site:

`http://www.worldtimesolutions.com`

The updated files should be unzipped and then saved in a location accessible to the TFTP server for installation later in this procedure.

- Check the TFTP server is functioning and has access to the unzipped network software files *(contained in the zip file MC1000L_x.x)*.
- Ensure the port you wish to update *(LAN 1 or LAN 2)* has a functioning network connection.
- If these have not already been installed, install the USB drivers *(see section 5.2)*.
- Once the USB drivers have been installed, connect the MC2000 to the PC using the supplied USB cable.
- Install *(if this has not already been installed)* and run the MC2000 Interface software application *(see section 5.2)*.
- In the main window of the MC2000 Interface software application, click on the *'Software'* tab *(see previous page figure 7.1)*.
- In the section labelled *'LAN 1 Software' (or 'LAN 2 Software' for LAN 2 updates)*, click on the *'Update'* button. The *'LAN 1 Software Update'* window *(or 'LAN 2 Software Update' for LAN 2 updates)* will appear *(see figure 7.3)*.
- In the section labelled *'LAN 1 Software Pre-Installation Check List' (or 'LAN 2...')* click the check boxes labelled *'Ensure LAN 1 has a functioning network connection'* and *'Check the TFTP server is operational and has access to the MC2000 network software files'*.
- Enter the IP address of the TFTP server into the *'TFTP Server Address'* text fields. When complete, ensure the check box is ticked.

What is TFTP?

Trivial File Transfer Protocol (TFTP) is a basic file transfer protocol used to transfer files across a computer network.

Various software based TFTP server implementations are available for free-of-charge download.

Please visit the World Time Solutions web site *(http://www.worldtimesolutions.com)* to obtain a list of recommended TFTP server implementations.

- Click the *'Start Update Procedure'* button. The replacement software files will now be downloaded from the TFTP server into the relevant port on the MC2000 across the local area network. The 'LAN 1 Software Update Progress' section details the procedures being performed and overall progress.

- Upon update completion, click the 'Exit' button.

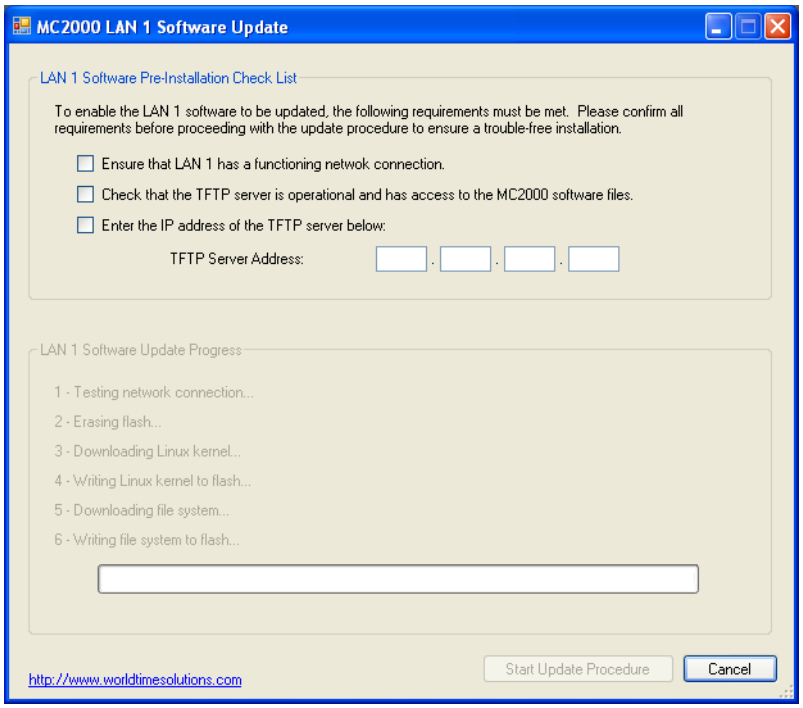

MC2000 LAN 1 Software Update
LAN 1 Software Pre-Installation Check List
To enable the LAN 1 software to be updated, the following requirements must be met. Please confirm all requirements before proceeding with the update procedure to ensure a trouble-free installation.
Ensure that LAN 1 has a functioning netwok connection.
Check that the TFTP server is operational and has access to the MC2000 software files.
Enter the IP address of the TFTP server below:
TFTP Server Address:
LAN 1 Software Update Progress
1 - Testing network connection...
2 - Erasing flash...
3 - Downloading Linux kernel...
4 - Writing Linux kernel to flash...
5 - Downloading file system...
6 - Writing file system to flash...
http://www.worldtimesolutions.com
Start Update Procedure
Cancel

Figure 7.3 - MC2000 LAN 1 Software Update window

The LAN 1 and LAN 2 software update procedures both begin by testing the network connection and then attempting to detect the replacement network software files on the TFTP server. If the replacement files are not detected, the update procedure will not complete and you may continue to use the relevant port *(LAN 1 or LAN 2)* with the original network software version.

For troubleshooting advice, please refer to appendix A.

A - Troubleshooting

Problem	Possible Cause	Solution
Time synchronisation error	Antenna not synchronised	Check sync LEDs *(see section 2.2.3)*
		Check sync status screen *(see section 1.4)*
		Refer to antenna user guide
	Cabling fault	Check sync LEDs *(see section 2.2.3)*
		Refer to antenna user guide *(and section 2.2.2)*
LAN 1 or LAN 2 link LED not illuminated	No connection to network for that port	Check connection to network switch/hub
		Check CAT5 patch cable integrity
LAN 1 or LAN 2 not responding to NTP requests	No connection to network for that port	Check connection to network switch/hub
		Check CAT5 patch cable integrity
	Linux not running	Check LAN1/LAN2 status screen *(see section 1.4)*
	MC2000 time not set	Refer to Time synchronisation error section above
		If not using an antenna system, manually set local time and date *(see section 6)*
Unable to access MC2000 web page on LAN 1 or LAN 2	No connection to network	Check connection to network switch/hub
		Check CAT5 patch cable integrity
	Linux not running	Check LAN1/LAN2 status screen *(see section 1.4)*
	HTTP access disabled	Enable HTTP access *(see section 5.1.3)*
	PC on different subnet to MC2000	Contact network administrator
Unable to access MC2000 via Telnet on LAN 1 or LAN 2	No connection to network	Check connection to network switch/hub
		Check CAT5 patch cable integrity
	Linux not running	Check LAN1/LAN2 status screen *(see section 1.4)*
	Telnet access disabled	Enable Telnet access *(see section 5.1.3)*
	PC on different subnet to MC2000	Contact network administrator

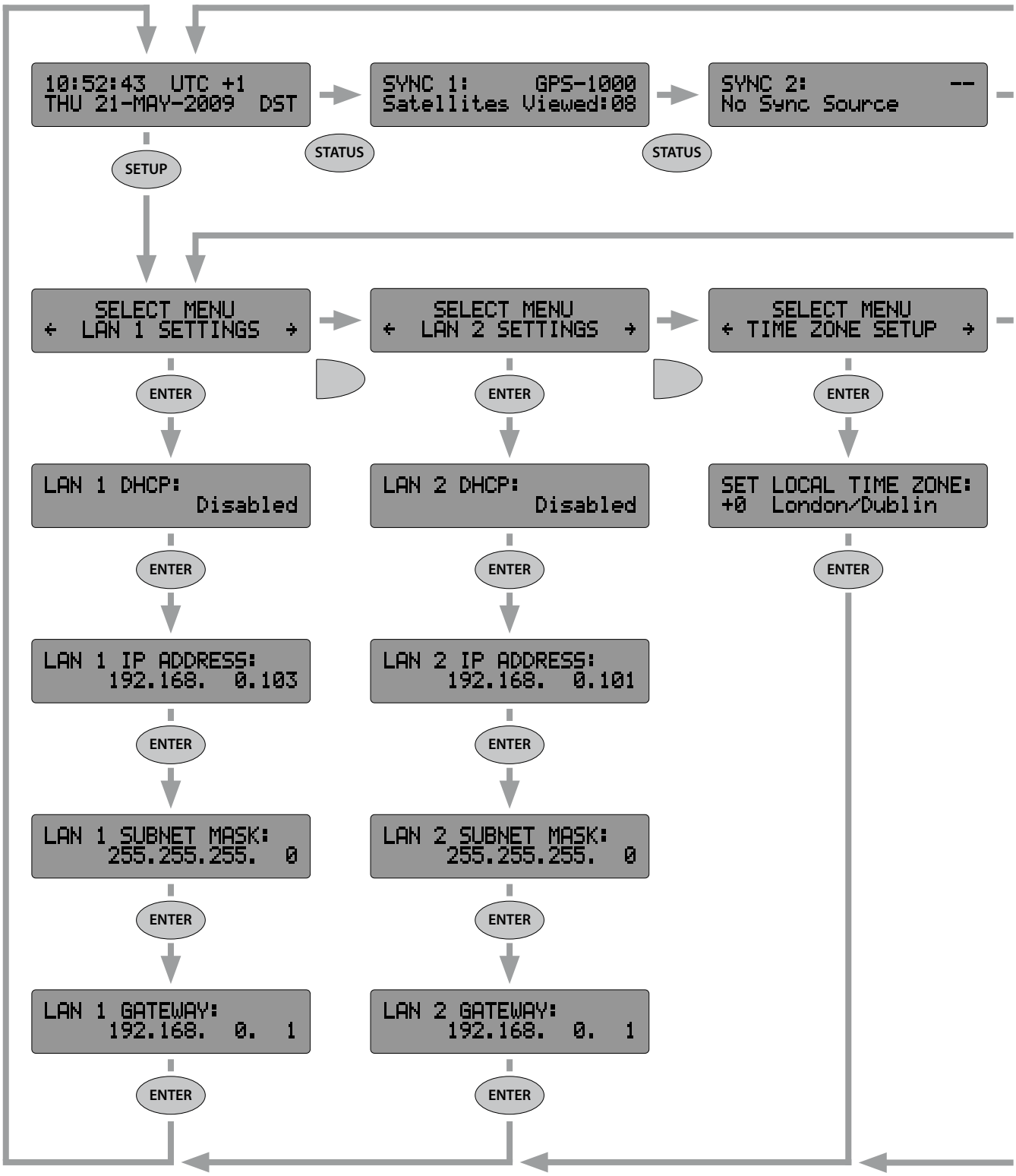
Table A.1 - Troubleshooting guide

Problem	Possible Cause	Solution
'MC2000 not found' error displayed in MC2000 Interface software application	MC2000 USB interface not detected by software application at startup	Check USB connection between MC2000 & PC *(see section 5.2)*
		Check USB cable *(see section 5.2)*
'Communication failure' error displayed in MC2000 Interface software application	Unspecified comms error between MC2000 and PC	Check USB connection between MC2000 & PC *(see section 5.2)*
		Check USB cable *(see section 5.2)*
'USB data error' displayed in MC2000 Interface software application	Error checking failure between MC2000 and PC	Check USB connection between MC2000 & PC *(see section 5.2)*
		Check USB cable *(see section 5.2)*
Liquid crystal display hard to read	Contrast set incorrectly	Adjust LCD contrast *(see section 6)*
Liquid crystal display backlight switching off automatically	LCD power save mode enabled	Disable LCD power save mode *(see section 6)*

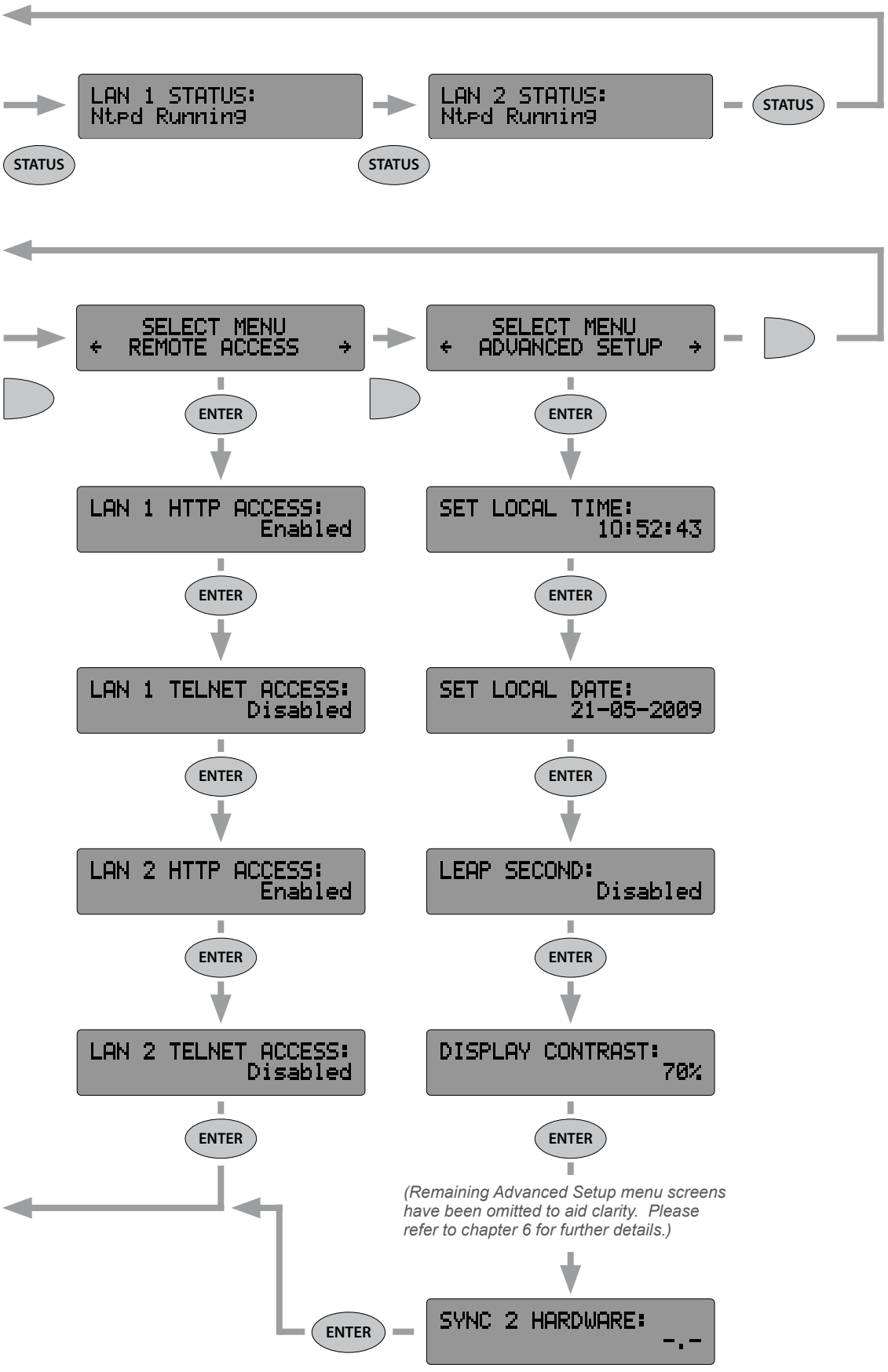
Table A.1 - Troubleshooting guide (cont..)

B - Menu structure

The flow diagram below shows the basic structure of the MC2000 programming menu.



PLEASE NOTE: Some detail has been omitted from this diagram to aid clarity.


LAN 1 STATUS:
Ntpd Running
LAN 2 STATUS:
Ntpd Running
STATUS
STATUS
STATUS
SELECT MENU
REMOTE ACCESS
SELECT MENU
ADVANCED SETUP
ENTER
ENTER
LAN 1 HTTP ACCESS:
Enabled
SET LOCAL TIME:
10:52:43
LAN 1 TELNET ACCESS:
Disabled
SET LOCAL DATE:
21-05-2009
LAN 2 HTTP ACCESS:
Enabled
LEAP SECOND:
Disabled
LAN 2 TELNET ACCESS:
Disabled
DISPLAY CONTRAST:
70%
(Remaining Advanced Setup menu screens have been omitted to aid clarity. Please refer to chapter 6 for further details.)
SYNC 2 HARDWARE:
-.-

C - Time zones

The table below lists the preprogrammed time zones. Time zone offsets followed by a * character indicates that the time zone has daylight saving changes.

UTC Offset	City / Time Zone
0	UTC/Reykjavik
0*	London/Dublin/Lisbon
0*	Casablanca
+1	Lagos/Algiers
+1*	CET/Paris
+2	Cape Town/Johannesburg/Harare
+2*	Athens/Sofia
+2*	Cairo
+2*	Jerusalem
+2*	Beirut
+2*	Amman
+3	Khartoum/Nairobi/Baghdad
+3*	Moscow (old)
+3.5*	Tehran
+4	Dubai/Moscow
+4.5	Kabul
+5	Karachi
+5.5	Mumbai/New Delhi
+5.75	Kathmandu
+6	Almaty/Dhaka
+6.5	Yangon
+7	Bangkok/Jakarta
+8	Singapore/Hong Kong/Beijing
+8*	Perth
+9	Seoul/Tokyo
+9.5	Darwin
+9.5*	Adelaide
+10	Brisbane
+10*	Vladivostok
+10*	Melbourne/Canberra/Sydney
+11	-
+12	Suva
+12*	Kamchatka/Anadyr
+12*	Auckland
+12.75*	Chatham Island
+13	-
+14	Kiritimati

Table C.1 - Preprogrammed Time Zones

UTC Offset	City / Time Zone
-10	Honolulu
-9	-
-9*	Anchorage
-8	-
-8*	Vancouver/San Francisco
-7	Phoenix
-7*	Edmonton/Denver
-6	Guatemala/San Salvador/Managua
-6*	Winnipeg/Houston/Chicago
-6*	Mexico City
-5	Lima/Kingston/Bogota
-5*	New York/Toronto/Nassau
-5*	Havana
-4.5	Caracas
-4	Santo Domingo/La Paz/San Juan
-4*	Halifax
-4*	Santiago
-3.5*	Newfoundland
-3	-
-3*	Brasilia/Sao Paulo
-3*	Montevideo
-3*	Buenos Aires
-2	-
-1	-

Table C.1 - Preprogrammed Time Zones (cont..)

D - Specifications

Typical Performance Specifications	
Synchronised accuracy:	Dependent on synchronisation source accuracy, time elapsed from first lock and cable lengths. Typically within 100nsec of synchronisation source PPS after 30 mins.
Unsynchronised holdover:	3.6 msec/hour (86 msec/day)

Supported Protocols
NTP v2 (RFC 1119), NTP v3 (RFC 1305), NTP v4 (no RFC), SNTP v3 (RFC 1769), SNTP v4 (RFC 2030), DHCP*, HTTP*, TELNET* (* can be disabled by user)

I/O Connections	
Ethernet connections:	2 x 10BASE-T / 100BASE-TX auto-sensing
USB connection:	USB Specification 2.0 compliant full-speed (12 Mbit/s)
Synchronisation inputs:	2 x dual-redundant 1000 series antenna connection ports
Mains power:	IEC C14 inlet

Mechanical & Electrical Specifications	
Dimensions:	483 x 44 x 164 mm (19.0” x 1.73” x 6.46”)
Weight:	2.5 kg
Power Supply:	100-240 VAC (50/60 Hz) universal power supply with IEC mains inlet
Power consumption:	0.06-0.04 AMPS

Environmental Specifications	
Operating temperature:	0 to 50 ºC
Relative humidity:	0% - 95%, noncondensing

Standards	
Electrical Safety:	BS EN 60950-1:2006
Radio Disturbance:	BS EN 55022:2006 (class B)
Immunity Characteristics:	BS EN 55024:2003

E - Certificate of Conformity

World Time Solutions

EC Declaration of Conformity

We World Time Solutions Limited
of 6 Clinton Crescent, Aylesbury, Buckinghamshire, HP21 7JW, UK

in accordance with the following Directives:

2006/95/EC	The Low Voltage Directive
2004/108/EC	The Electromagnetic Compatibility Directive

hereby declare that:

Equipment:	Dual NTP Time Reference System
Model number:	**MC2000**

is in conformity with the applicable requirements of the following documents:

Ref. No.	Title	Edition / Date
BS EN 60950-1	Information Technology Equipment - Safety	2006
BS EN 55022	Information Technology Equipment - Radio disturbance characteristics (class B)	2006
BS EN 55024	Information Technology Equipment - Immunity characteristics	2003

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications. The system complies with all applicable Essential Requirements of the Directives.

Signed:

CE 11

Name:	Anthony Honeyball
Position:	Managing Director
Date:	15th December, 2011

Ref: WTSCF2011/01

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